

NOVEL TECHNOLOGIES - WHAT ARE THE INCENTIVES?

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In parallel with efforts to find ways to safely confine high level radioactive waste from the biosphere, there is the possibility of destroying at least some of the radioactive species by means of nuclear reactions that will transform them into innocuous non-radioactive material.

An overview will be given of results obtained at the European Organization for Nuclear Research (CERN) by the group led by Carlo Rubbia, showing the possibility of destroying by transmutation practically all long lived ($T \gg 30$ years) radioactive species.

Transuranic elements can all be safely fissioned by the very hard neutron spectrum existing in the energy amplifier, a mildly subcritical accelerator-driven system. Moreover, energy is produced in this process, which can largely offset the cost of the operation.

Among the fission products, a few - such as technetium-99 and iodine-129 - have long radioactive half-lives (200 000 years and 15 million years, respectively). The transmutation by adiabatic resonance crossing (TARC) experiment at CERN (supported by the European Union) has shown that these species can be transmuted into stable elements with a high efficiency, using peculiarities of the neutron capture cross-section and a principle dubbed by Rubbia as adiabatic resonance crossing. It has been shown on the basis of this experiment and of a computer simulation that an energy amplifier can transmute its own technetium-99 waste without loss of energy production.

In conclusion, these novel ideas, while they might not completely suppress the need for geological disposal, can conceivably reduce the volumes to be stored by a factor of 1000 or so. The European Union 5th Framework Programme has allocated R&D funds for that purpose with a view to building a demonstration plant during the 6th Framework Programme.